Restriction Requirement

3. A three-way restriction requirement was issued in connection with the claims pending in this Application. Applicants filed an election of invention on June 4, 2002 (Paper No. 8), in which Applicants elected without traverse Group 1 (claims 1 and 3-17). The Examiner withdrew the non-elected claims 18-21, which have been canceled in the foregoing Amendments.

Art of Record

4. Applicants acknowledge receipt of Form PTO-892 (part of Paper No. 9) listing additional references identified by the Examiner.

Claim Objections and Claim Rejections under 35 U.S.C. §112, second paragraph

5. Various claims have been rejected under 35 U.S.C. §112, second paragraph, for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Additional claims were objected to due to various informalities. Applicants have amended the claims to implement the Examiner's suggestions and otherwise accommodate these objections and rejections. Accordingly, Applicants respectfully request that these objections and rejections be withdrawn.

Rejections Under 35 U.S.C. §102(e)

6. The Examiner has rejected claims 1 and 3-17 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,127,038 to McCullough *et al.* (hereinafter, "McCullough"). Based upon the following Remarks only, Applicants respectfully request reconsideration and withdrawal of these rejections.

7. The Examiner asserts that first coating layer 14 of McCullough is disposed in a cavity on the printed circuit board and on surfaces of the printed circuit board immediately surrounding the cavity so as to bridge across the one or more cavity openings and to at least partially infill the cavity wherein the cavity is substantially inaccessible to subsequently-applied coatings. The Examiner refers Applicants to column 3, lines 8 and 52-64 of McCullough in support of this interpretation. Independent claim 12 was rejected for similar reasons. Applicants respectfully disagrees.

8. McCullough is directed to a conformal coating and methods for conformally coating a substrate, such as a printed circuit board and components mounted thereon, to provide corrosion resistance. It is well known to coat printed circuit boards with a conformal coatings to prevent corrosion and short circuits from exposure to humid conditions. The particular problem of conventional conformal coatings addressed by McCullough is that the conformal coatings delaminate or pull away from the corners of leads and boards or otherwise develop cracks which wick moisture during temperature and humidity cycles. Such cracks and areas of delamination form pockets which may "entrap water and dissolve and/or disassociate contaminants confined therein." (*See,* McCullough, col. 1, lns. 5-10; lns. 33-44.) To overcome such problems, the McCullough conformal coating provides corrosion resistance by preventing cracks and spaces from forming in the conformal coating that could result from incomplete coating coverage or delamination. The McCullough conformal coating thereby prevents influx of water and contaminants that can cause shorting and corrosion of leads. (*See,* McCullough, col. 1, lns. 59-64.)

9. The McCullough conformal coating has two coating layers. The first coating layer 14 is deposited onto an ultra-clean printed circuit board to provide a bonded coating that will not delaminate from the printed circuit board or the components mounted thereon. The first coating layer 14 of McCullough is preferably vacuum deposited on the ultra-clean circuit board and components mounted thereon to maximize coverage of board, component and lead surfaces while providing uniform deposition. This first coating 14 is deposited to cover all of the exposed surfaces on the printed circuit board including all surfaces of the components and leads, "including between and behind lead surfaces." (*See,* col. 2, lns. 19-31; col. 3, lns. 8-11; lns. 61-64. Emphasis added.) In other words, referring to the embodiment illustrated in Figure 1 of McCullough, the first coating layer 14 is deposited on most and preferably all of the printed circuit board surfaces 20, component surfaces 22 and lead surfaces 24 that may be potentially exposed to air, moisture or water. (*See,* McCullough, Fig. 1; col. 3, lns. 8-11.)

10. McCullough notes that depositing first coating layer 14 on all surfaces of the printed circuit board and its components is possibly being impractical or impossible. (*See,* McCullough, col. 3, ln. 11-13.) This may result in gaps and flexible openings in the

first coating layer 14. (*See,* McCullough, col. 2, lns. 36-39.) To eliminate cracks and spaces in the first coating layer 14 which result from incomplete coating coverage or delamination, the McCullough conformal coating includes a second coating layer 16. (*See,* McCullough, Fig. 1; col. 2, lns. 35-46; col. 3, ln. 65-col. 4-25.) Second coating layer 16 comprises a corrosion-inhibiting fluid applied to the first coating layer to fill in gaps, movable areas and flexible openings occurring in first coating layer 14 due to variations or openings in the first coating layer 14 or openings caused by board topography or component configuration, such as openings or areas associated with moveable parts or switches. (*See,* McCullough, col. 2, lns. 35-46; col. 3, ln. 65 – col. 4, ln. 4.)

11. Thus, first coating layer 14 is not, as alleged by the Examiner, disposed in a cavity of the printed circuit board and on the surface of the printed circuit board immediately surrounding the cavity "so as to bridge across and at least partially infill the one or more openings of the cavity, wherein the filler material renders the cavity substantially inaccessible to subsequently applied coatings." (*See,* amended claim 1, above.) In fact, because first coating layer 14 is to be applied uniformly to all surfaces on the components and leads (including behind and between leads) to prepare the surfaces for application of second coating layer 16, first coating layer 14 lacks the appropriate thickness and viscosity to bridge across cavity openings as recited in Applicants' independent claim 1.

12. Even if first coating layer 14 bridged printed circuit board cavity openings, which it does not, it would prevent McCullough's second coating layer 16 from being applied to the surfaces of the first coating layer 14 covering the printed circuit board surfaces defining the cavity. Thus, applying first coating layer 14 so as to bridge across and infill a circuit board cavity to render the cavity substantially inaccessible would prevent McCullough from achieving its purpose of providing the disclosed dual-layer conformal coating consisting of first coating layer 14 covered by second coating layer 16. For at least this reason, Applicants assert that McCullough neither teaches nor suggests Applicants' claimed invention.

13. Furthermore, first coating layer 14 of McCullough is described as possibly containing gaps and openings to the printed circuit board is in direct contrast to rendering the coated portions of the printed circuit board (that is, cavity surfaces) substantially

inaccessible to subsequently applied coatings. A first coating layer 14 with gaps and openings to the printed circuit board cannot render the coated portions of the printed circuit board (that is, cavity surfaces) substantially inaccessible to subsequently applied coatings as recited in Applicants' claim 1. For this reason as well, McCullough's first coating layer 14 does not meet the teachings of Applicants' claimed invention.

14. McCullough's second coating layer 16 also fails to meet the limitations of Applicants' filler material as recited in independent claim 1. As noted above and shown in Figure 1, McCullough's second coating layer 16 is a substantially uniform coating that is applied to first coating layer 14 to prevent corrosion. McCullough neither teaches nor suggests applying second coating layer 16 to "bridge across one or more openings of cavities on the printed circuit board so as to render the cavity substantially inaccessible to subsequently-applied coatings," as recited in independent claim 1. In contrast, second coating layer 16 coats first coating layer 14 in and around printed circuit board cavities without sealing or otherwise preventing access to subsequently-applied coatings. For at least this reason, Applicants respectfully assert that McCullough's second coating layer 16 neither teaches nor suggests Applicants' invention as recited in independent claim 1.

15. For at least the same reasons, Applicants respectfully assert that independent claim 12 is patentable over the art of record. Claim 12 recites a printed circuit board having a layer of non-electrically-conducted filler material conformingly adhered to printed circuit board surfaces in the one or more regions having a highly variable and cavitatious surface to provide a contoured, contiguous filler material surface having gradual transitions, wherein the filler material bridges across cavity openings and at least partially infills the cavities." (*See,* amended claim 12, above.) As noted, first coating layer 14 is vacuum deposited on exposed surfaces of the printed circuit board. As shown in McCullough's Figure 1, the application of first coating layer 14 does not change the surface contours of the printed circuit board. Accordingly, should a first coating layer 14 be applied to a printed circuit board having highly variable and cavitatious surface, the resulting coated printed circuit board would have the same highly variable and cavitatious surface. McCullough's first coating layer 14, therefore, cannot "provide a contoured, contiguous filler material surface having gradual transitions" as recited in independent claim 12. Further, for the reasons noted above with respect to independent claim 1, first coating

layer 14 of McCullough does not bridge across the cavity openings and at least partially infill the cavities on the printed circuit board as recited in independent claim 12. In addition, for the reasons noted above, second coating layer 16 also does not meet these limitations of independent claim 12. For at least these reasons, Applicants respectfully assert that McCullough neither teaches nor suggests the recitations of independent claim 12. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested.

16. The dependent claims in this application depend directly or indirectly from independent claims 1 and 12, and incorporate all of the subject matter of their respective independent claim. Furthermore, the dependent claims add additional subject matter which makes them independently patentable in and of themselves over the art of record. Accordingly, Applicants respectfully request that the rejections of dependent claims 3-11 and 13-17 be reconsidered and withdrawn.

CONCLUSIONS

17. Applicants respectfully assert that this application is now be in condition for allowance. A notice to this effect is respectfully requested.

Respectfully submitted,

Lowell E. Kolb

By: _____
Michael G. Verga
Registration No. 39,410
Tel. (617) 438-2871

Docket No. 10001844-1
Dated: November 27, 2002

MARKED UP VERSION OF CLAIMS SHOWING ALL CHANGES MADE

[ATTACHMENT 1 TO THE AMENDMENT FILED IN RESPONSE TO THE OFFICE ACTION DATED AUGUST 28, 2002 IN U.S. PATENT APPLICATION 09/813,257.]

1. (Twice Amended) A printed circuit board comprising:

a printed wiring board;

a plurality of components mounted on said printed wiring board, wherein the printed circuit board has a cavity with one or more openings to the surface of the printed circuit board; and

an electrically non-conductive filler material disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across [the one or more cavity openings] and [to] at least partially infill the one or more openings of the cavity, wherein the filler material renders the cavity [is] substantially inaccessible to subsequently-applied coatings.

3. (Twice Amended) The printed circuit board of claim 1, wherein the cavity comprises:

a volume of space defined by [the] leads of a component, the component body and said printed wiring board, wherein the volume of space has a plurality of openings to the surface of the printed circuit board between neighboring component leads.

11. (Twice Amended) The printed circuit board of claim 1, wherein the subsequently-applied coating comprises:

a layer of dielectric coating that conformingly coats exposed surfaces of the printed circuit board including the filler material, the dielectric coating formed of a low viscosity material that facilitates accurate application of the dielectric coating using a spray atomized technique, wherein the at least one of the [one or more] cavity openings is sufficiently large to prevent the dielectric coating from bridging across the cavity opening without the presence of the filler material.

12. (Twice Amended) A printed circuit board comprising:

a printed wiring board;

a plurality of components having a device body mounted on said printed wiring board to form one or more regions of the printed circuit board having a highly variable and cavitatious surface including a plurality of cavities defined by [an series of] component leads, the component body adjacent the series of leads, and a portion of the printed wiring board below the series of leads, wherein each cavity includes a plurality of openings to the surface of the printed circuit board; and

a layer of non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces in the one or more regions to provide a contoured, contiguous filler material surface having gradual transitions, wherein the filler material bridges across the cavity openings and at least partially infills the cavities.

15. (Twice Amended) The printed circuit board of claim 14, further comprising:

a low viscosity, high adherence dielectric coating that, when applied and cured, [ppcured,] covers predetermined portions of said printed circuit board including at least a portion of the one or more regions coated with said filler material, wherein the filler material prevents the dielectric coating from entering the plurality of cavities.